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Beef Cattle Management Suggestions



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COLLEGE OF AGRICULTURE

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

CIRCULAR 1026

CONTENTS

PROTEIN SUPPLEMENTS	1
Crude protein	1
Single versus mixed-protein sources	1
Urea in supplements	3
Adding urea to corn silage	5
Adding urea to high-moisture corn	6
Self-feeding supplements	7
High-protein corn	7
VITAMINS	8
FEED ADDITIVES	9
Stilbestrol	9
Antibiotics	10
Enzymes	11
Rumen cultures	11
PARASITE CONTROL	11
SILAGE, HAYLAGE, AND HIGH-MOISTURE CORN	13
FEED PREPARATION	15
FREQUENCY OF FEEDING	16
GENERAL MANAGEMENT	16
SPACE AND EQUIPMENT REQUIREMENTS	17
Feed and water facilities	17
Feedlot facilities	17
Feed bunk design	18

Nutrient requirements of cattle and ration ideas are given in a companion publication, Circular 1025.

Publication prepared by Livestock Extension Specialists
H. G. Russell B. A. Weichenthal

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This publication provides ideas and management suggestions for operating a beef feedlot. Facilities and methods differ widely in Illinois cattle feeding, but good management is the key to any profitable operation.

PROTEIN SUPPLEMENTS

1. *What does the term "crude protein" mean on a feed tag?*

Crude protein means all of the nitrogenous compounds in a feed. The crude-protein content, or equivalent, of a feed is determined by finding the nitrogen content and multiplying the result by 6.25. The nitrogen content of proteins averages about 16 percent ($100 \div 16 = 6.25$). A 40-percent feed contains 40 pounds of crude protein in 100 pounds.

2. *Do I need to feed a mixture of protein so that my steers will get the right balance of amino acids?*

No. The protein a steer eats is used by the bacteria in his paunch for their own growth. These bacteria then move on down into the digestive tract, and the steer uses them for his protein needs.

Regardless of the kinds of protein a steer eats, he uses only one — bacterial protein. These bacteria can use any kind of protein or may manufacture protein from nitrogen fed in urea. So it makes no difference to the steer whether his protein comes from one source or several. However, some mixtures may be more palatable than single ingredients, causing him to eat a little more feed.

3. *Is it true, then, that I can feed single ingredients, such as soybean meal, and get good results with a finishing ration?*

In finishing ration tests at Illinois, Iowa, and Ohio, soybean meal was as satisfactory as the more complex supplements containing molasses and various sources of protein. *All of these rations contained some legume hay.* Mineral content and vitamin content were adequate.

4. *Is it true that as cattle get older they need less protein supplement than they did when they were young?*

Older cattle gain satisfactorily with a lower percentage of protein in their total ration. Steer calves will require a minimum of 11 percent crude protein in a growing ration, and limited research suggests 13 percent crude protein in high-energy finishing rations for calves. Yearling cattle require 10.5 to 11 percent crude protein; and two-year-olds, 10 percent. Keep in mind the fact that the crude protein supplied by most roughages is less digestible than that supplied in grains and protein supplements.

5. What is Purdue Supplement A?

Purdue Supplement A is a protein supplement designed for use with low-quality roughages — corncobs, cornstalks, etc. Here is the formula:

650 lb. soybean meal (44%)
140 lb. cane molasses
140 lb. dehydrated alfalfa meal (17%)
52 lb. steamed bone meal or dicalcium phosphate
18 lb. iodized salt
2 gm. cobalt carbonate
625 gm. zinc oxide
10,000,000 I.U. vitamin A

6. What is the value of feeding roasted whole soybeans to cattle?

Cooking or roasting whole soybeans is not necessary for ruminants, as it is for swine. Cattle fed uncooked ground soybeans have performed as well as other cattle fed soybean meal. Soybeans contain 38 percent protein and 18 percent fat, and the following table shows the value of a bushel of soybeans when fed to cattle, taking into account differences in competitive sources of energy and protein:

<i>Value of No. 2 corn per bu.</i>	<i>Value of soybean meal per ton</i>		
	<i>\$80</i>	<i>\$90</i>	<i>\$100</i>
	<i>Equivalent value of whole soybeans per bu.</i>		
\$1.00	\$2.17	\$2.39	\$2.62
1.15	2.22	2.45	2.67
1.30	2.28	2.50	2.73

7. Is there any need for a 20-percent supplement in the cattle feeding business?

Yes, but for reasons more important than its value as a source of additional protein. For instance, you may be feeding a ration of excellent-quality haylage and shelled corn. You have little or no need for additional protein, but you do want to feed vitamin A, possibly vitamin D if the cattle are in a barn, stilbestrol, antibiotics, and minerals. In this case, a supplement that fits your requirements may be the most practical and economical method of supplying these additives.

8. Do I need to feed a protein supplement when my cattle are getting a full feed of good legume hay or haylage and a little grain?

No. Protein from the forage will be adequate. Additional grain will usually be cheaper than the protein supplement. (See 7 above.)

Urea in Supplements

9. What is urea?

Urea is a concentrated source of nitrogen — actually a high-grade nitrogen fertilizer. It is usually available in prill or “buckshot” form which is a convenient form for mixing.

10. What is the protein equivalent of urea?

A hundred pounds of 44-percent-protein soybean meal contains 44 pounds of crude protein. A hundred pounds of urea has a protein equivalent of 281 pounds.

Each 100 pounds of urea contains 45 pounds of nitrogen. Since protein is about 16 percent nitrogen, there is one pound of nitrogen in each 6.25 pounds of protein ($100 \div 16 = 6.25$). Thus, the protein equivalent of 100 pounds of urea is 281 pounds (45×6.25).

11. Is 1 pound of urea equal to 6 or 7 pounds of soybean meal?

No. Urea furnishes only nitrogen and contains no energy, vitamins, or minerals. Natural proteins furnish other nutrients, especially energy, that are of value to cattle. To make 1 pound of urea equal 6 or 7 pounds of soybean meal, some quick source of energy, such as molasses or corn, must be added. Therefore, 1 pound of urea and 6 pounds of corn supply about the same amount of energy and nitrogen as 7 pounds of soybean meal.

12. How can I tell how much urea is mixed in a supplement?

The level of urea in a feed may be quoted as:

The percent of urea in the feed. If the amount of urea is stated as a percent, multiply this figure by 2.81 to determine the “percent protein equivalent” furnished by urea.

The percent of total protein furnished as urea. If the urea level is stated as “percent protein equivalent furnished by urea,” divide this figure by 2.81 to determine how much urea was used in the feed.

13. Is it best to use protein supplements containing urea with low-grade roughage rations?

No. A pound of protein from a supplement containing urea is no better, and probably no worse, than a pound from natural ingredients, such as soybean meal. This is true whether the roughage is high quality (like corn silage) or low quality (like corncobs). However, the supplement and ration must contain enough high-energy feed for proper rumen bacterial action.

14. If urea is no better than other sources of protein, why use it?

Because it is relatively cheap and offers a way of making beef cattle supplements at less cost per pound of protein equivalent. Urea is used by feed manufacturers to produce supplements having a higher protein equivalent than the natural-plant protein ingredients, such as soybean and linseed meal.

If the fiber content of the supplement is 10 percent or more, it is likely that the natural ingredients saved by using urea were replaced with lower-quality feeds.

15. How is urea converted to protein?

The microorganisms in the rumen require protein for their growth. They produce microbial protein that can be used by the host animal. They can manufacture protein by using nitrogen from urea if there is a readily available source of carbohydrates supplied by grain or molasses.

16. How should high-urea supplements be used in beef cattle rations?

They should be thoroughly mixed with the grain ration or, preferably, with the complete diet. Because urea is extremely soluble, its nitrogen becomes available very quickly in the rumen in the form of ammonia. If the ration mixture including urea is always available in the feed bunk or a self-feeder, frequent feeding by the cattle will result in urea supplements being used about as efficiently as soybean meal. See discussion of high-urea supplements in Circular 1025.

17. How do liquid supplements containing urea, molasses, minerals, alcohol, etc., compare with dry protein supplements in value?

Feedlot tests at several universities have shown that performance was similar whether liquid supplements or dry supplements of similar composition were fed.

Liquid supplements are popular at some feedyards because they are easy to mix in a complete ration. Molasses can mask the flavor of urea and add energy to the ration. There can be differences in the amount of water in liquid supplements in which the same levels of protein equivalent, minerals, and additives are guaranteed.

18. Should sulfur be added to rations in which urea is included?

When urea is used, the nitrogen:sulfur ratio should be between 10:1 and 15:1 to insure adequate utilization of the urea. The nitrogen and sulfur content of your ration can be calculated using average feed analysis values, or you can have a ration analysis for actual nitrogen and sulfur content.

In some experiments addition of sulfur has not improved feedlot performance of urea-supplemented rations. However, the sulfur content of natural feedstuffs can vary, and some rations containing urea will require sulfur supplementation.

Commercial protein supplements containing urea are likely to be fortified with a source of sulfur. Home-mixed rations can be fortified with sulfur by using calcium sulfate (CaSO_4 or gypsum). In a simple mineral mixture of equal parts of limestone, dicalcium phosphate, and salt, replace 20 percent of the limestone with calcium sulfate.

Adding Urea to Corn Silage

19. What is the urea-mineral mixture you add to corn silage at ensiling time to make a "balanced" silage for mineral and protein?

First, it is necessary to identify the class and weight of cattle to which the silage will be fed. If we fortify the silage for *finishing 600-pound calves*, the nutrient requirements on an air-dry (90 percent dry matter) basis are:

11 percent crude protein
 .27 percent calcium
 .23 percent phosphorus
 .50 percent salt

This protein level meets or exceeds the requirements of all classes of cattle except lighter calves and young bulls on a growing or wintering ration. The calcium and phosphorus levels are suitable for all classes of cattle except lighter calves on full feed. The salt allowance is adequate for all cattle on a finishing ration and is above the requirements of young cattle on a growing ration.

The urea-mineral additive mixture is formulated to fortify corn silage with a standard composition of 30 percent dry matter, 2.3 percent crude protein, 0.10 percent calcium, and 0.06 percent phosphorus.

Corn Silage Additive Mixture	Pounds or percent
Urea, 45 percent nitrogen.....	65
Dicalcium phosphate.....	13
Salt, trace-mineralized.....	22
	<hr/> 100

20. How much of this mixture should I use per ton of fresh silage?

Add a half-pound of the corn silage additive mixture per ton of fresh forage for each percent of dry matter in the fresh forage.

<i>When fresh forage contains</i>		<i>Pounds of additive mixture per ton</i>
<i>Percent moisture</i>	<i>Percent dry matter</i>	
70	30	15
68	32	16
66	34	17
64	36	18
62	38	19
60	40	20

Adding Urea to High-Moisture Corn

21. What urea-mineral mixture could be used to supply protein equivalent and minerals for high-moisture corn as it goes into storage?

At the University of Illinois the following formula was used successfully:

<i>High-Moisture Corn Additive Mixture</i>		<i>Pounds or percent</i>
Urea, 45 percent nitrogen.....		40
Limestone, feed-grade.....		33
Salt, trace-mineralized		27
		<u>100</u>

22. How much of this mixture should I use per ton of high-moisture corn?

Add 0.4 pound of the high-moisture corn additive mixture per ton of corn for each percent of dry matter in the corn.

<i>When high-moisture corn contains</i>		<i>Pounds of additive mixture per ton</i>
<i>Percent moisture</i>	<i>Percent dry matter</i>	
20	80	32
22	78	31.2
24	76	30.4
26	74	29.6
28	72	28.8
30	70	28

23. Is it practical to use the urea-mineral fortified corn silage and high-moisture corn in the same ration?

Yes. A 1967 experiment at the University of Illinois (with 700-pound yearling steers fed for 136 days) produced average daily gains varying from 2.66 to 3.26 pounds per head daily. The cattle gaining at the rate of 2.66 pounds consumed an average daily ration of 8.6 pounds of "balanced" high-moisture corn and 31.2 pounds of "balanced" silage. Steers that gained at the rate of 3.26 pounds had an average daily ration of 17.8 pounds of corn and 18.2 pounds of silage.

24. Is this ration of "balanced" high-moisture corn and "balanced" corn silage a complete feeding program for yearling cattle?

No. We still need to think of stilbestrol, vitamin A, antibiotics, and possibly other additives. Stilbestrol could be implanted; vitamin A could be given by injection. But a supplemental feed as a carrier for these additives might be more practical.

25. I want to add urea, but no minerals, to corn silage as it goes into storage. How much urea should I use?

Use the table with question 20 and add 65 percent of the figure given in the right-hand column.

Self-Feeding Supplements

26. Can the protein supplement be satisfactorily self-fed to cattle?

No. Cattle will overeat on protein supplement fed as a meal if allowed free access to it. However, salt has been used to limit protein intake under pasture conditions. A mixture of $\frac{1}{3}$ salt and $\frac{2}{3}$ soybean meal has resulted in an intake of 1 to $1\frac{1}{2}$ pounds of soybean meal per day under normal conditions. The $\frac{1}{2}$ to $\frac{3}{4}$ pound of salt per head daily increases the cost substantially and forces cattle to stay near the water supply.

The "wheel" self-feeders for liquid supplements are designed for self-feeding.

High-Protein Corn

27. Some varieties of corn contain higher levels of protein (10-14.7 percent) than regular corn (7.8-9.9 percent). Is it advisable for me to produce this high-protein corn for cattle feed, since it would greatly reduce the need for additional protein supplement?

Yields of high-protein corn are substantially below those of regular corn, even when extra nitrogen fertilizer is used. Until plant breeders can raise the yields of high-protein corn varieties, it is doubtful that cattle feeders would be justified in growing it for feed.

28. What is the value of high-lysine (Opaque-2) corn for cattle?

Higher lysine levels are probably not of any value to cattle if protein levels are not higher. If a high-lysine corn variety also has higher protein, this protein can be used effectively by cattle. In a recent Purdue test, heifers gained slightly faster and more efficiently on Opaque-2 corn (12 percent crude protein) than on normal corn. The same amount of supplement was fed in each case.

VITAMINS

29. What vitamins do I need to add to my beef-cattle rations?

Vitamins are broadly divided into two groups, fat-soluble (A, D, E, K) and water-soluble (B-complex). *Vitamin A is considered to be the only one of major practical significance in beef cattle feeding.* Since the rumen organisms can synthesize the B-complex vitamins and vitamin K and since vitamin E is of no practical significance, cattle need only vitamins A and D. Since vitamin D is produced in the skin of the animals in direct sunlight, only vitamin A needs to be supplied in the ration of cattle exposed to sunlight.

30. What is true vitamin A? How can it be obtained?

True vitamin A is a chemically formed compound. It does not occur in plants. However, it is furnished in most beef cattle rations in the form of its precursor, carotene. Vitamin A supplements are available. They can be purchased and added to the ration at nominal cost.

31. Where do we find carotene?

Green, rapidly growing pasture, silage, and good-quality hay contain relatively large amounts of carotene; most grains, other than yellow corn, contain relatively little. Sunbleaching hay and storing corn (especially during the summer months) cause a loss of carotene through oxidation.

32. Vitamin A levels are generally expressed in terms of I.U. What does this mean?

The potency of most vitamin A supplements is expressed as International Units (I.U.). The National Research Council (N.R.C.) considers 1 milligram of carotene to be equivalent to 400 I.U. of vitamin A activity for beef cattle. This conversion allows for the relative inefficiency of cattle in converting carotene to vitamin A. See the Illinois recommendations on page 6 of Circular 1025.

33. What difference does it make if I supplement my ration with vitamin A or with carotene?

True vitamin A is a chemically formed compound. To be available, it does not require conversion in the animal, as does carotene. The vitamin A may also be cheaper in many situations.

FEED ADDITIVES

34. *What are the recommendations for using STILBESTROL?*

Stilbestrol is a synthetic chemical compound having the properties of the female sex hormone, estrogen. By feeding stilbestrol to steers on a full feed of grain, you can expect 15 to 20 percent faster gains, with a 10 to 12 percent saving in feed per pound of gain. Current Food and Drug Administration (FDA) regulations for stilbestrol allow feeding at a rate varying from 5 to 20 milligrams per head per day. Cattle under 750 pounds body weight may not be fed more than 10 milligrams per head per day.

The stilbestrol content of a cattle supplement may be listed in milligrams per pound or as a percent. Five milligrams per pound of supplement is 0.0011 percent, 10 milligrams per pound, 0.0022 percent, 15 milligrams per pound, 0.0033 percent, and 20 milligrams per pound, 0.0044 percent.

Because the indiscriminate use of stilbestrol is dangerous to both cattle and man, its use in a cattle feed has been approved *only* for when it has been incorporated in a carefully regulated premix and sold to commercial feed manufacturers to be mixed with normal supplements for beef cattle finishing rations. Like many other feed additives, stilbestrol is subject to regulation by the Food and Drug Administration. Only authorized manufacturers with proper mixing facilities are permitted to add such materials to feeds.

Stilbestrol should *not* be fed to any breeding animal. Sows and gilts intended for the breeding herd should *not* follow cattle fed stilbestrol.

The use of stilbestrol in a wintering ration composed mostly of roughage with very little grain will increase gain 0.1 to 0.15 pound per day with no extra feed. Implants may be the most economical way to use stilbestrol in this case.

Illinois research has shown no effect on shrink or yield and a slight (although not significant) decrease in carcass grade in cattle fed stilbestrol that were fed as long as control cattle not fed stilbestrol.

Selected animals may be implanted so that stilbestrol-treated and nonstilbestrol-treated animals can be fed together. Gains are about the same on implanted cattle as on those fed stilbestrol.

The use of stilbestrol in the feed *must be discontinued at least 48 hours prior to slaughter.*

Implanting requires facilities for catching and handling cattle. Side effects, such as low loins and high tailheads, are sometimes rather severe right after cattle are implanted. These tend to disappear as the feeding period progresses.

Stilbestrol implants are NOT recommended for feedlot heifers.

Steer calves weighing less than 600 pounds should be implanted with 24 milligrams of stilbestrol; steers weighing over 600 pounds, with 30 or 36 milligrams of stilbestrol. Research shows that the first stilbestrol implant lasts 7 to 8 months; a second implant at the end of that time will produce additional gain. However, if cattle are to be marketed within the next 100 to 120 days, they probably should not be reimplanted. Side effects from the second implanting might still be present at marketing time. Feed stilbestrol for the 100 to 120 days.

In a typical steer-finishing program, you can expect an additional 50 to 90 pounds per steer at market time on the same amount of feed with stilbestrol.

Suckling calves implanted with 12 or 15 milligrams of stilbestrol at 3 months of age can weigh as much as 25 pounds more at weaning time. The response to stilbestrol in the feedlot after weaning should not be adversely affected unless the implanting is done less than 120 days before weaning. Heifer calves have been implanted at 3 months of age without any effect on breeding performance when these animals went into the herd.

35. How do other implants such as Synovex, Rapigain, or Ralgro compare with stilbestrol?

A number of tests have shown other implants to improve rate of gain and feed efficiency as much as stilbestrol or more. However, they have been more expensive than stilbestrol.

36. Should heifers be fed M.G.A. or stilbestrol?

Feedlot heifers can be fed M.G.A. in the range of 0.25 to 0.5 milligram per head daily or 10 milligrams of stilbestrol per head daily. Even though M.G.A. is more expensive, research results suggest slightly higher returns with M.G.A. as compared with returns from stilbestrol. M.G.A. suppresses heat, and the problems of riding and going off feed during heat are largely eliminated. M.G.A. is not beneficial for steers but it will not harm them.

37. What are ANTIBIOTICS? How practical are they in cattle finishing rations?

Antibiotics are chemicals that inhibit the growth of or destroy living organisms. They are classified as drugs, not nutrients. We can make the following general statements about them: *Animals respond most to antibiotic feeding when under stress.* The stress may be caused by crowding, cold weather, muddy lots, or shipping.

Recent research trials indicate that low levels (70 to 80 milligrams) of antibiotics will reduce the incidence of liver abscesses in beef cattle on high-energy finishing rations. Young animals on high-roughage rations respond more to antibiotics than do older cattle on finishing rations.

If antibiotics are used, they should be the broad spectrum type, such as aureomycin or terramycin. If antibiotics are used in the ration routinely, the recommended allowance is 70 to 80 milligrams per head per day. *Follow the manufacturer's recommendation.*

A combination of antibiotic and sulfamethazine is available for feeding during the first 28 days that calves are in a lot. University tests have shown increased gains and a faster start on feed, but this early advantage may diminish as the feeding period continues. Yearlings have shown little response to this treatment.

After shipping or other stress, limit the amount and length of time of high-level feeding of antibiotics to practices approved by the Food and Drug Administration.

38. Do ENZYMES have a place in cattle finishing rations?

Enzymes have given variable and inconclusive results when added to cattle rations. The kinds of ingredients in the ration seem to influence the response to enzymes. Enzymes are fairly expensive, and more research is needed before their use can be recommended to Illinois feeders.

39. Will my cattle benefit from the addition of RUMEN CULTURES to their finishing rations?

Research shows that feeding a well-balanced ration has a greater effect in promoting a desirable rumen population than adding a relatively small number of microorganisms in a live rumen culture. In a few experiments, adding a live rumen culture to the ration increased daily gain an average of 3 percent. In most tests, when live rumen culture was added to the ration, neither daily gain nor feed efficiency was increased.

PARASITE CONTROL

40. Should feeder cattle be wormed regardless of whether they are of Western, Southern, or Illinois origin?

Surveys have shown that many cattle in Illinois feedlots are heavily parasitized. Cattle originating in the Midwest and in Southern and Southwestern states will very likely benefit from treatment. Cattle from the Northwest and higher altitudes are less likely to be parasitized.

Your veterinarian can determine the degree of infestation and advise you concerning treatment.

Thiabendazole has proved to be more effective than phenothiazine but costs more. Each can be used in the feed, as a bolus, or as a drench. Use of either one must be according to manufacturer's recommendations and within requirements of the Food and Drug Administration.

41. What can I do if my cattle are lousy and are losing their hair?

You can use either lindane or malathion. With lindane, use 1½ pints of 20-percent emulsion concentrate in 100 gallons of water. If the lindane is used, do not spray within 30 days of slaughter and do not dip within 60 days of slaughter. With malathion, use 3 quarts of 50- to 57-percent emulsion concentrate in 100 gallons of water.

Use care to avoid contaminating feed and water.

Depending on animal size, prepare 1 to 2 gallons per animal of either material to be used as a spray. For best control, spray twice, 14 days apart.

42. Are the systemic insecticides effective for grub control?

Yes, when properly used. The best time for treatment is at the end of the heel fly season. This will vary in different areas or regions of the country. Grubs migrate through the animal's body. In general, during the late fall and winter months, the grubs (if present) will be in the gullet and neural canal. Killing grubs when they are in these areas may result in toxic side reactions. Therefore, in using these systemic insecticides, you must know the origin of the cattle and carefully follow specific recommendations for the time and method of application.

If in the past your feeder cattle have averaged five or more grubs per head, it would probably pay you to use a grub-control treatment.

The systemic insecticides — Coumaphos (Co-Ral), crufomate (Ruelene), and trichlorfon (Neguvon) — used as sprays or pour-ons will provide excellent control of grubs. Famphur (Warbex), as a pour-on only, is also effective.

For native Illinois beef cattle, treatment should be applied in August and September in the southern half of the state and in September and October in northern Illinois. Shipped-in feeder cattle that have not been treated may have grubs. These will show up in December to March, and if cattle are sold for slaughter during this period, may cause excessive carcass trim and financial loss. If cattle are marketed in the fall or in late spring, the grubs will not be present. Check to be sure the cattle have not already been treated for grubs by the original owner.

SILAGE, HAYLAGE, AND HIGH-MOISTURE CORN

43. *How does high-moisture corn (22 to 30 percent moisture) compare with dry corn in value?*

In some early feeding trials high-moisture ground ear corn was shown to be 10 percent more efficient than dry ground ear corn, apparently because of greater utilization of the wet cob. There was no significant difference in average daily gain.

High-moisture rolled or ground shelled corn is usually assumed to be equal to dry ground shelled corn although some tests have shown it to be 5 to 10 percent more efficient.

Two important advantages of high-moisture corn are improved acceptability to cattle and more favorable weather with less field loss at harvesting time. For storage in conventional silos and bunker silos, grinding high-moisture shelled corn appears to help avoid some of the problems that develop in storing such corn.

44. *How about putting a complete finishing ration, both grain and alfalfa silage, into the silo at filling time?*

Illinois trials with an "all-in-one" silage composed of 60 percent alfalfa and 40 percent dry ground shelled corn or 50 percent alfalfa and 50 percent high-moisture corn gave as rapid and cheap gains for steer calves as a finishing ration composed of shelled corn, corn silage, soybean meal, and hay. Both lots gained about 2.5 pounds per head per day.

45. *Should high-moisture shelled corn be crimped, ground, or cracked for best results?*

Most tests with high-moisture shelled corn have shown an improved feed conversion from some form of processing. Coarse rolling or grinding is satisfactory although medium grinding is used when high-moisture corn is stored in open silos or bunkers.

46. *What effect does high-temperature artificial drying have on the nutritive value of corn?*

In Illinois and Nebraska tests, supplemental heat up to 190° F. had no effect on the digestibility or palatability of the heat-dried corn for beef cattle.

47. *Why is there interest in oat silage? How does it compare with legume-grass silage?*

An acre of oats fed to cattle as silage is worth much more than an acre harvested as grain. In two years' tests at the University of Illinois,

an acre of oats as silage produced beef cattle gains worth more than \$120. The same oats harvested as grain were worth less than half as much. Harvesting oats as silage also helps obtain good stands of new seedings.

In an Illinois test, oat silage cut in the late milk stage was equal to legume-grass silage when used in growing rations for steer calves. The gains were 1.74 and 1.8 pounds, respectively, per day when the silage was fed with 2.2 pounds of legume hay and 3.5 pounds of corn per head daily. Oat silage cut at a more mature stage should be supplemented with additional protein.

48. How does the feeding value of the total corn plant compare with that of the grain portion only?

When only the corn kernels are removed from the field at harvest time, approximately 40 percent of the feeding value of the corn plant is left in the field:

	<i>Total digestible nutrients per acre</i>	
	<i>Pounds</i>	<i>Percent</i>
Shelled corn.....	5,376	61
Corncobs.....	840	10
Cornstalk	2,514	29
Total corn plant.....	8,730	100

49. How does corn silage compare with legume hay as a roughage for steers on full feed?

The following results show that corn silage can replace hay for finishing rations:

	<i>Mixed hay</i>	<i>Limited corn silage</i>
Days on feed.....	105	105
Beginning weight, lb.....	811	812
Sale weight, lb.....	1,048	1,064
Av. daily gain, lb.....	2.25	2.40
Av. daily ration, lb.		
Crimped shelled corn.....	14.44	13.11
Hay.....	6.24	
Silage		13.34
Supplement.....	2.00	2.00

50. What is the value of haylage in cattle finishing rations?

Normally we think of haylage as having a moisture content of 40 to 50 percent; hay, 15 to 20 percent; and grass-legume silage, 65 to 70 percent.

Haylage fed alone to thin yearling cattle produced gains of about 2 pounds per head daily in a South Dakota test. About 1,500 pounds of haylage was required to produce 100 pounds of gain.

Illinois trials compared hay and haylage for steers fed high-moisture corn and soybean meal at comparable levels. One lot ate a daily average of 7.52 pounds of haylage (15 percent moisture equivalent); the other had a daily average hay allowance of 5.83 pounds. The cattle on haylage gained 0.18 pound more per head daily, but feed costs per 100 pounds of gain and carcass merit were the same in the two lots.

A third lot of cattle fed haylage but no soybean meal gained the same as the hay lot — 2.66 pounds per head daily, but feed cost per 100 pounds of gain was about \$1.00 less. Haylage (like good legume hay and silage) is an excellent source of protein, minerals, and vitamins.

FEED PREPARATION

51. *I have heard a lot about pelleting rations for beef cattle. What do the research data show?*

In a test at the Dixon Springs Agricultural Center, yearling steers that were fed a complete ground ration (hay and corn ground together) gained 2.58 pounds per day, at a feed cost of \$19.29 per hundred pounds of gain. When they were fed the same ration as pellets, they gained 2.75 pounds per day, at a feed cost of \$16.86 per hundred pounds of gain. The pelleted feed was worth \$6.39 more per ton than the ground feed.

52. *How about pelleting hay for a calf wintering ration?*

At the Dixon Springs Agricultural Center, alfalfa-timothy mixed hay was fed to comparable lots of steer calves as baled hay and as pellets. Both rations came from the same uniform sample of baled hay. Daily gains were 0.63 pound per head with the long hay and 1.73 pounds per head with the pelleted hay. The calves fed long hay gained 116 pounds for each ton of hay fed; those fed pelleted hay gained 221 pounds per ton of hay. Calves fed long hay ate 9.48 pounds of dry matter per head daily; those fed pelleted hay, 14.29 pounds.

53. *Does type of grinder used have any effect on the feeding value of ground ear corn?*

Illinois tests showed no difference in performance from ear corn processed through either a burr mill, a hammer mill, or a reel-type knife mill.

54. *Is it necessary to grind shelled corn for beef cattle?*

No. Dry shelled corn fed as whole grain is equal to or slightly better than ground shelled corn in feed value.

55. What is the feeding value of various grains compared with corn?

The following data give the best indication of the relative value of the various grains:

Grain	Total digestible nutrients	Crude protein	Fiber	Maximum recom- mended in total grain mixture, by weight, for Illinois con- ditions
			(percent)	
Corn	80.1	8.7	2	100
Oats	70.1	12	11	25
Barley	77.7	12.7	5.4	50
Wheat	80	13.2	2.6	50
Milo	79.4	10.9	2.3	50
Rye	76.5	12.6	2.4	50

All of the grains except corn should be ground for the most efficient use by feeder cattle. Young calves can use unground grain most efficiently.

Heavy oats fed as 50 percent, by weight, of the grain mixture will produce satisfactory gains during the first half of the finishing period. Barley may be "scabby," and rye is subject to ergot infestation; both lower palatability.

FREQUENCY OF FEEDING

56. Should I consider feeding my cattle more than twice a day?

Illinois studies on the effect of the frequency of feeding on feedlot performance have shown that cattle fed six times a day in one trial ate 17 percent more feed per head daily than those fed twice daily. Feeding six times a day produced 21 percent faster gains and slightly more efficient feed conversion. A second trial compared twice-a-day feeding, six-times-a-day feeding, and self-feeding. The steers fed six times daily consumed 5 percent more feed, gained 10.6 percent faster, and produced a pound of gain on 4.5 percent less feed than the steers fed twice daily. The self-fed steers ate more than either of the other two groups, were intermediate in rate of gain, and were lowest in feed efficiency.

GENERAL MANAGEMENT

Provide trace-mineralized salt and a simple mineral mixture, each free-choice at all times.

If hogs are allowed to follow cattle fed whole grain, allow 1 hog for every 3 calves or 1 hog for every 2 older cattle. If grain is rolled, ground, or cracked, this practice is of lesser value.

Treat shipping fever cases promptly and for two to three consecutive days to prevent chronic pneumonia.

Dehorn calves and yearlings and tip the horns of older cattle.

If practical, feed steers and heifers separately.

Worm cattle when the need is demonstrated. (See page 11.)

Treat cattle for external parasites when the need is demonstrated. (See page 12.)

SPACE AND EQUIPMENT REQUIREMENTS

Feed and Water Facilities

Feeding space is determined by the size of the animal and the number of animals that must eat or drink at one time. In the following discussion, animals weighing up to 600 pounds are considered to be calves; those weighing more than 600 pounds (including yearlings and big cattle), older cattle.

Hand feeding (all cattle eat at the same time):

Calves, 18 to 22 inches

Older cattle, 22 to 26 inches

Mature cows, 26 to 30 inches

Self-feeding (feed is always available)

Hay or silage, 4 to 6 inches

Grain and supplement, 3 to 4 inches

Grain and silage, 6 inches

Watering

Provide plenty of clean, fresh water at all times. Allow 3 to 4 inches of open water-tank space per head on pasture, or 1 automatic watering bowl for every 40 cattle.

A satisfactory winter water temperature range is 40° to 50° F.; summer, 60° to 80° F.

Feedlot Facilities

Provide the following lot space:

Paved lots: 40 to 50 square feet per head including open housing.

Dirt lots: 150 to 200 square feet per head including paved aprons for bunks and waterers. (More is desirable under some soil and climatic conditions.)

Provide a **paved area** of at least 12 feet around waterers, feed bunks, and roughage racks. Slope all aprons along bunks, sheds and waterers 1 inch per foot.

Allow **slope** of 1 inch per foot in paved lots and $\frac{1}{2}$ inch or more in dirt lots, depending on soil and climatic conditions.

Provide beef cattle **housing** as economically as possible. Open sheds are usually adequate.

Open sheds: Calves, 15 to 20 square feet of space per head. Older cattle, 20 to 25 square feet of space per head.

Confined housing: Allow 30 square feet per 1,000-pound animal on solid floors or 20 square feet on slotted floors, plus space for alleys, feeders, and waterers.

Provide **artificial shade** in hot climates, unless cattle have access to natural shade. Build shade 8 to 10 feet high. Provide the following space:

Calves, 15 to 25 square feet per head

Older cattle, 25 to 35 square feet per head

Except in mild climates, provide **bedding** to help keep cattle dry, comfortable, and healthy. Recommended materials include straw, corn-cobs, sawdust, shavings, peanut hulls, and similar material. Use the type that is available at lowest cost. Mounds covered with cobs or other bedding in open lots are desirable.

Feedlot **fences** need to be made of plank or steel cable. Build fences at least 60 inches high.

Provide **rubbing devices** that dispense insecticides to help control external parasites and make cattle more comfortable. However, these devices should not replace other, external parasite control measures.

Provide convenient **facilities for restraining, sorting, loading, and handling** animals to minimize production losses and prevent injury to personnel.

Feed Bunk Design

Apron

Minimum slope should be $\frac{1}{2}$ inch per foot ; 1 inch per foot of slope will be nearly self cleaning.

The width should be 12 feet if the area below will be muddy or covered with snow part of the year.

A step 4 to 6 inches high and 12 to 16 inches wide next to the bunk for the front feet of the animals will prevent manure buildup along or in the bunks.

Bunk dimensions

Width should provide:

48 inches of eating space if fed from both sides

54 to 60 inches if bunk is divided by mechanical feeder

18 inches of bottom width if fed from one side of bunk

Height of bunk floor above apron should be 4 to 6 inches where apron can be kept scraped, and 8 to 12 inches if frozen mud, snow, etc., will accumulate.

Throat height should be up to 18 inches for calves, 22 inches for older cattle and mature cows. Increase to 30 inches only if hogs will run with cattle.

Roof

The roof should be 5 to 6 feet wider than the bunk to protect the bunk and to provide minimum shade. It should be wide and high enough to clear cleaning equipment and provide shelter for the bunk and summer shade for the cattle.

For additional information on design, layout, feeding equipment, and handling ideas, see the "Beef Housing and Equipment Handbook," which can be obtained through your local extension adviser or ordered from the Department of Agricultural Engineering, University of Illinois at Urbana-Champaign.

***If you have questions about the beef business,
see your county extension adviser, or write to
the Department of Animal Science, University
of Illinois, Urbana, Illinois 61801.***

Urbana, Illinois

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